PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
JOHN D. SIMMONS
AKIN GUMP STRAUSS HAUER & FELD LLP
ONE COMMERCE SQUARE , SUIET 2200
2005 MARKET STREET
PHILADELPHIA, PA 19103

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Applicant's or agent's file reference 681443-1WO	Date of mailing (*day/month/year*) 21 SEP 2006 FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US06/15310	21 April 2006 (21.04.2006)	22 April 2005 (22.04.2005)

International Patent Classification (IPC) or both national classification and IPC

IPC: H01L 21/336(2006.01),29/79
USPC: 438/268,270;257/330

Applicant

ICEMOS TECHNOLOGY CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450	29 July 2006 (29.07.2006)	Long Tran
Facsimile No. 571-273-3201		Telephone No. 571-272-1797

Form PCT/ISA/237 (cover sheet) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/15310

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ on paper

☐ in electronic form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in electronic form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US06/15310

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims NONE	YES
	Claims 1-6,8-19,21-26	NO
Inventive step (IS)	Claims NONE	YES
	Claims 1-26	NO
Industrial applicability (IA)	Claims 1-26	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE
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Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:
Claims 1 - 6, 8 - 19, 21 -26 lack novelty under PCT Article 33(2) as being anticipated by Nitta et al. (US Patent No. 6,307246).

Regarding claims 1, 2, 12, 13, 14, 15, 25 and 26, '246, figures 1 - 24, illustrates a method of manufacturing a semiconductor device comprising:

providing a semiconductor substrate (1) having first and second main surfaces opposite to each other, the semiconductor substrate having a heavily doped region of a first conductivity type (n^+) at the second main surface and having a lightly doped region of the first conductivity type (n^-) at the first main surface;

providing in the semiconductor substrate a plurality of trenches and a plurality of mesas with each mesa having an adjoining trench and a first extending portion extending
from the first main surface toward the heavily doped region to a first depth position, at least one mesa having a first sidewall surface and a second sidewall surface, each of the plurality of trenches having a bottom (column 5, lines 3 - 29);

doping with a dopant of a second conductivity type the first sidewall surface of the at least one mesa to form a first doped region of the second conductivity type or of the first conductivity (column 5, lines 22 - 28);

doping with the dopant of the second conductivity type the second sidewall surface of the at least one mesa to form a second doped region of the second conductivity type, wherein diffusing the dopants of the second conductivity type into the at least one mesa prior to doping with the dopants of the first conductivity type(column 5, lines 3 - 39);

doping with a dopant of the first conductivity type the first sidewall surface of the
at least one mesa to provide a second doped region of the first conductivity type at the first sidewall, and doping with the dopant of the first conductivity type the second sidewall surface of the at least one mesa to provide a fourth doped region of the first conductivity type at the second sidewall (column 13, lines 22 - 29; column 10, lines 15 - 26; column 13, lines 6 - 21);

diffusing a dopants of the second conductivity type into
lining at least the trenches (5a) adjacent to the at least one mesa with an oxide material by CVD (column 14, lines 46 - 52); and

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filling at least the trenches (5a) adjacent to the at least one mesa with one of a semi-insulating material and an insulating material (column 13, lines 22 - 29).

Regarding claims 3, 4, 16 and 17, the '246 discloses forming a layer of undoped polysilicon, after the oxide lining step, over the trench bottoms and the mesas, each including the first and second sidewalls; filling the plurality of trenches with one of a semi-insulating material and an insulating material includes filling the plurality of trenches with a semi-insulating polycrystalline silicon (column 13, lines 22 - 29).

Regarding claims 5, 6, 18 and 19, the '246 discloses the first sidewall surface has a first predetermined inclination maintained relative to the first main surface and the second sidewall surface has a second predetermined inclination maintained relative to the first main surface, wherein the first and second sidewall surfaces are generally perpendicular relative to the first main surface.

Regarding claims 8 - 11 and 21 - 24, the '246 discloses the implanting of the dopant of the first and second conductivity types are both implanted at a predetermined angle (column 5, lines 32 - 33).

Claims 7 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Nitta et al. (US Patent No. 6,307246) and Remarks.

Regarding claims 7 and 20, the '246 discloses the claimed invention of claim 1 or claim 14, respectively, but fails to teach the plurality of trenches are formed utilizing one or more of plasma etching, reactive ion etching (RIE), sputter etching, vapor phase etching and chemical etching.

However, plasma etching, reactive ion etching (RIE), sputter etching, vapor phase etching and chemical etching are well known processes in the semiconductor art for forming trenches. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize plasma etching, reactive ion etching (RIE), sputter etching, vapor phase etching and chemical etching to form trenches of the '246, since it has been held to be within the general skill of a worker in the art to select a known method on the basis of its suitability for the intended used method as a matter of obvious design choice.

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